

NATIONAL BUREAU OF STANDARDS REPORT

6979
Supplement-1

Recheck of Lamps Used for International Intercomparisons
Carried out at Bureau International Des Poids et Mesures

by

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Velma I. Burns

Marshall J. McDonald



U. S. DEPARTMENT OF COMMERCE
NATIONAL BUREAU OF STANDARDS

THE NATIONAL BUREAU OF STANDARDS

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Photometry and Colorimetry Section

Metrology Division

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REMARKS

REMARKS

RECHECK OF
THE LUMINOUS INTENSITY OF 16 LAMPS
AND
THE LUMINOUS FLUX OF 8 LAMPS
USED FOR
INTERCOMPARISONS CARRIED OUT
AT
BUREAU INTERNATIONAL DES POIDS ET MESURES

1. PURPOSE

This report gives the results of measurements made on the lamps returned from the BIPM after intercomparisons there with photometric standards from other National Laboratories.

The values assigned prior to sending the lamps to BIPM were given in NBS Report 6979, dated October 1960.

2. STANDARDS AND METHODS

The various groups of lamps were measured in terms of the same groups of standards as outlined in NBS Report 6979. The same methods described in that report were used in rechecking the lamps.

3. RESULTS

The results of the recheck and the originally reported values are given in Tables A, B, C, D, and E.

Table A. Luminous Intensity at 2042°K (BIPM 1951 Scale)
(2039°K NBS Scale)

Lamp No.	Volts (set)	Amperes		Candelas		Average
		Before	After	Before	After	
NBS3757	97.200	0.5541	0.5541	11.85 \pm .04	11.87 \pm .04	11.86
NBS3759	97.900	.5595	.5591	11.90 \pm .03	11.91 \pm .03	11.90
NBS3761	98.200	.5380	.5379	11.64 \pm .03	11.65 \pm .03	11.65
NBS3762	98.200	.5586	.5585	12.08 \pm .06	12.11 \pm .06	12.09
TS1522	9.956	5.2814	5.2781	13.74 \pm .03	13.70 \pm .03	13.73
				12.24 \pm .02 ₇	12.25 \pm .02 ₉	12.25

(Note: Lamps TS1525 and TS1539 listed in Report 6979 were broken in shipment)

Table B. Luminous Intensity at 2353°K (BIPM 1951 Scale)
(2352°K NBS Scale)

Lamp No.	Volts (set)	Amperes		Candelas				Average
		Before	After	Before		After		
NBS3764	92.300	0.3399	0.3399	22.68	$\pm .06$	22.62	$\pm .02$	22.66
NBS3767	90.900	.3434	.3436	21.95	$\pm .07$	22.04	$\pm .09$	21.98
NBS3769	91.800	.3403	.3402	22.34	$\pm .08$	22.39	$\pm .00$	22.36
NBS3771	90.900	.3463	.3466	22.22	$\pm .05$	22.32	$\pm .08$	22.26
TS3019	13.065	3.1552	3.1555	29.34	$\pm .09$	29.36	$\pm .03$	29.34
TS3020	12.800	3.2554	3.2550	29.63	$\pm .06$	29.69	$\pm .08$	29.65
TS3032	12.882	3.2652	3.2645	29.40	$\pm .12$	29.46	$\pm .08$	29.41
				25.36	$\pm .05_5$	25.41	$\pm .02_9$	25.38

Table C. Luminous Intensity at 2854°K (NBS Scale)

Lamp No.	Volts (set)	Amperes		Candelas				Average
		Before	After	Before		After		
NBS5612	107.700	3.822 ₇	3.824 ₆	643.6	± 2.1	643.7	± 1.9	643.6
NBS5613	107.400	3.807 ₁	3.806 ₆	638.7	± 2.4	634.9	± 4.6	636.8
NBS5617	107.600	3.799 ₆	3.802 ₈	633.2	± 2.3	633.6	± 2.5	633.4
NBS5619	106.800	3.818 ₆	3.816 ₃	629.4	± 5.0	627.7	± 4.1	628.6
				<u>636.2</u>	± 2.0	<u>635.0</u>	± 2.0	<u>635.6</u>

Table D. Luminous Flux at 2353°K (BIPM 1951 Scale)
(2356°K NBS Scale)

Lamp No.	Volts (set)	Amperes		Lumens				Average
		Before	After	Before		After		
NBS3780	99.000	0.3206	0.3206	232.2	± 0.6	231.5	± 1.7	231.8
NBS3782	98.500	.3206	.3208	231.2	± 0.5	230.5	± 1.4	230.8
NBS3783	98.200	.3195	.3200	226.1	± 0.7	225.2	± 1.2	225.6
NBS3784	99.100	.3218	.3219	<u>233.5</u>	± 0.3	<u>233.2</u>	± 2.6	<u>233.4</u>
				<u>230.8</u>	± 0.4	<u>230.1</u>	± 1.9	<u>230.4</u>

Table E. Luminous Flux at 2788°K (BIPM 1951 Scale)
(2811°K NBS Scale)

Lamp No.	Volts (set)	Amperes		Lumens		Average
		Before	After	Before	After	
NBS3772	108.90	1.7377	1.7382	2738 \pm 14	2760 \pm 18	2749
NBS3773	110.00	1.7582	1.7587	2795 \pm 8	2814 \pm 9	2804
NBS3775	109.00	1.7337	1.7336	2750 \pm 18	2759 \pm 10	2754
NBS3776	108.90	1.7427	1.7422	2745 \pm 8	2759 \pm 12	2752
				2757 \pm 6.0	2773 \pm 9.2	2765

4. DISCUSSION

A. Intensity at 2042°K, 2353°K, and 2854°K. Statistical analysis indicates no change in the intensity of these lamps and the averages of the "before" and "after" values given in the last column of Tables A, B, and C should be used to represent our assignments of luminous intensity to these lamps at the time they were at the BIPM.

B. Flux at 2353°K and 2788°K. Statistical analysis indicates that the luminous flux of the lamps at 2353°K have not certainly changed, while those at 2788°K may have increased slightly. The averages of the "before" and "after" values, given in the last column of Tables D and E, should be used to represent our assignments of luminous flux to these lamps at the time they were at the BIPM.

Superseded

(Superseding page 3 as originally issued)

Table E. Luminous Flux at 2788°K (BIPM 1951 Scale)
(2811°K NBS Scale)

Lamp No.	Volts (set)	Amperes		Lumens		Average
		Before	After	Before	After	
NBS3772	108.90	1.7377	1.7382	2724 [±] 14	2746 [±] 18	2735
3773	110.00	1.7582	1.7587	2781 [±] 8	2800 [±] 9	2790
3775	109.00	1.7337	1.7336	2736 [±] 18	2745 [±] 10	2740
3776	108.90	1.7427	1.7422	2731 [±] 8	2745 [±] 12	2738
				2743 [±] 6.0	2759 [±] 9.2	2751

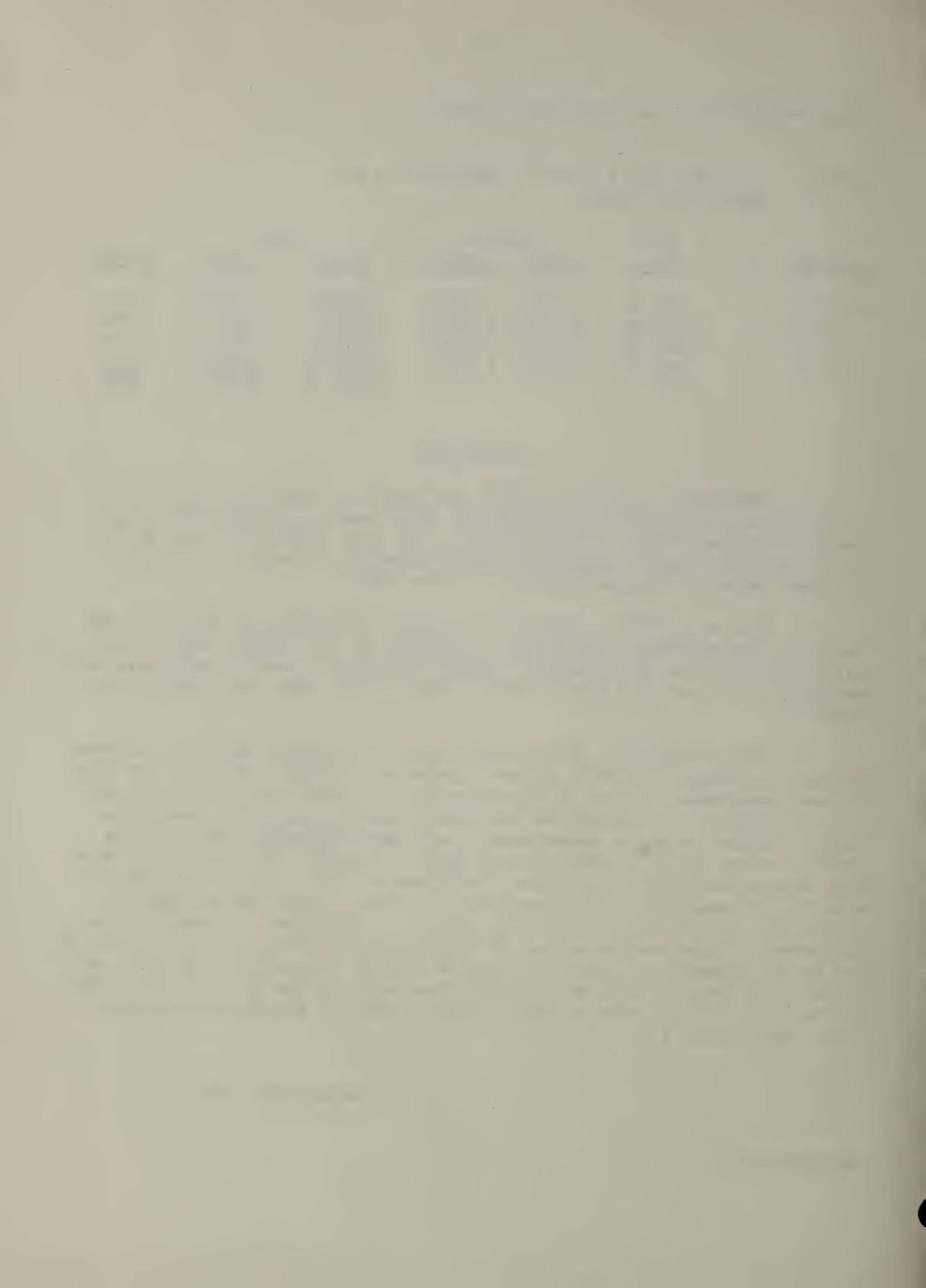
4. DISCUSSION

A. Intensity at 2042°K, 2353°K, and 2854°K. Statistical analysis indicates no change in the intensity of these lamps, and the averages of the "before" and "after" values given in the last column of Tables A, B, and C should be used to represent our assignments of luminous intensity to these lamps at the time they were at the BIPM.

B. Flux at 2353°K. Statistical analysis indicates no change in the luminous flux of these lamps and the averages of the "before" and "after" values given in the last column of Table D should be used to represent our assignments of luminous flux to these lamps at the time they were at the BIPM.

C. Flux at 2788°K. Statistical analysis indicates that the luminous flux of the lamps at 2788°K may have increased slightly. However, in view of past experience of lack of reproducibility of results on lamps of this size and type, it is recognized that the difference of 0.6% between the "before" values based on measurements made about September 1960 and the "after" values based on measurements made in December 1961 may result more from measurement differences than from changes in the lamps. Accordingly, a series of experiments to extend over a period of time, and designed to locate the source of the difficulty, is being undertaken. Meanwhile, the assignment of the average values of luminous flux to these lamps in Table E, and to our standards of luminous flux at 2788°K, are made on the basis of having them embody a unit of luminous flux equal to the unified unit listed as the 1952-1957 (x) mean at the bottom of Table X, Procès-Verbaux CIPM, 26-B, 1958, Annex P8.

January 25, 1962



U. S. DEPARTMENT OF COMMERCE
Luther H. Hodges, *Secretary*

NATIONAL BUREAU OF STANDARDS
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THE NATIONAL BUREAU OF STANDARDS

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WASHINGTON, D.C.

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Metrology. Photometry and Colorimetry. Refractometry. Photographic Research. Length. Engineering Metrology. Mass and Scale. Volumetry and Densimetry.

Heat. Temperature Physics. Heat Measurements. Cryogenic Physics. Equation of State. Statistical Physics.

Radiation Physics. X-ray. Radioactivity. Radiation Theory. High Energy Radiation. Radiological Equipment. Nucleonic Instrumentation. Neutron Physics.

Analytical and Inorganic Chemistry. Pure Substances. Spectrochemistry. Solution Chemistry. Standard Reference Materials. Applied Analytical Research.

Mechanics. Sound. Pressure and Vacuum. Fluid Mechanics. Engineering Mechanics. Rheology. Combustion Controls.

Organic and Fibrous Materials. Rubber. Textiles. Paper. Leather. Testing and Specifications. Polymer Structure. Plastics. Dental Research.

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Mineral Products. Engineering Ceramics. Glass. Refractories. Enameled Metals. Crystal Growth. Physical Properties. Constitution and Microstructure.

Building Research. Structural Engineering. Fire Research. Mechanical Systems. Organic Building Materials. Codes and Safety Standards. Heat Transfer. Inorganic Building Materials.

Applied Mathematics. Numerical Analysis. Computation. Statistical Engineering. Mathematical Physics. Operations Research.

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